

International Journal of **Supply Chain and Logistics**

(IJSCL)

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Performance of Agricultural Firms Listed on the Nairobi Securities
Exchange**



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Materials handling Functions Influence on Supply Chain Performance of Agricultural Firms Listed on the Nairobi Securities Exchange

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Accepted: 7th May, 2026, Received in Revised Form: 23rd May, 2026, Published: 5th June, 2026



ABSTRACT

Purpose: The study assessed the influence of material handling functions on the supply chain management of agricultural firms listed at the Nairobi Securities Exchange.

Methodology: A cross-sectional descriptive survey design was used in the research to target 156 workers from six listed agricultural companies. Questionnaires, interviews, and document analysis were used to gather data, which was then examined using regression models, correlation, and descriptive statistics.

Findings: The results showed that Materials Handling also had a significant influence ($B = 0.701$, $p < 0.005$), accounting for 32.7% of Supply Chain Management variation.

Unique Contribution to Theory, Policy and Practice: From findings, the study concluded that Materials Handling is a strong predictor of Supply Chain Management Performance. Recommendations from the study include, firms should adopt modern Materials Handling practices such as automation and mechanization of materials handling processes. Policymakers should incentivize investments in Materials Handling infrastructure, especially in growing industrial zones.

Keywords: *Warehousing, Supply Chain Management, Performance*

1.1 Introduction

Material handling comes before processing of completed products held for distribution to customers (Coyle et al., 2014). Material handling is essential in a supply chain network as it performs important functions that help the development of materials, handling items, de-amassing vehicle loads, making stock keeping unit combinations and gathering materials for shipments purposes (Andre Langevin and Riopel Diana, 2015).

Shorter product life cycles, higher customer expectations, and an increasingly competitive global market are the causes of this. Various writers have defined logistics in different ways. In order to satisfy customer quality criteria, it has recently been defined as organizing, carrying out, and managing transportation operations as well as the storage of goods, including services and related data, from the point of origin to the site of use (Lowe, 2002). Logistics is management of the movement of goods and/or persons, and the activities supporting these processes in the systems where they occur. Therefore, the subject of logistics are, first of all, the flows of physical goods (their value can be estimated in financial terms) from the sources they were obtained, to the activities of manufacturing, to the customer (the consumptive element).

Logistics must handle three different kinds of flows in order for this interaction to occur: (i) financial, (ii) material, and (iii) information. In conclusion, logistics is the process of transporting goods to the appropriate location at the appropriate time. Material handling, production scheduling, information processing, storage, and demand forecasting are just a few of the functional components that make up logistics. Gourdin (2001). According to Christopher (2005), logistics is a system composed of subsystems that cooperate and share a common objective. Usually, the objective is to satisfy client needs. The subsystem manages value-added activities.

The goal of the current study was to systematically assess how internal customers in Marcopolo S/A's manufacturing department in Caxias do Sul, RS, perceived the implemented modifications to materials handling management. The following specific goals were set to accomplish this goal: explain how the company's materials-handling procedures have changed; assess the existing material-handling flow in manufacturing; confirm the improvements; and assess internal customers' satisfaction levels with the new system (Stock & Lambert, 2001).

Materials handling enables production flow by adding dynamism to static elements such as materials, products, equipment, layout, and human resources (Stock & Lambert, 2001; Chopra & Meindl, 2001). Groover (2001) highlights that, despite its importance, materials handling is a topic that companies frequently treat superficially. However, other authors have perceived its relevance. During the period in which Shingo (1996) contributed to the development of the Toyota Production System, he developed the Production Function Mechanism, which explains how the production phenomenon occurs.

1.2 Statement of the Problem

Maximizing the flow of materials, goods, and information throughout the supply chain while accounting for variables like cost, quality, quantity, and time is the goal of supply chain management. In compliance with international organization standards, this includes strategic planning to identify the most effective transportation routes, ideal warehousing techniques and facilities, and suitable packaging processes (International organization standards, 2007).

According to Amoro (2011), most manufacturing firms in Kenya face problems of stock outs, over supply, over stocking, stock obsolescence, poor forecasting, stock pilferage, poor responsiveness to customer needs and lack of proper material handling equipment, methods and practices results into poor performance. According to Ross, (2010) many firms in manufacturing sector in Dar E Salaam complained of additional material handling costs that resulted into decline in profit margins.

It is evident from earlier research that logistical functions result in inconsistent findings. Tan's (2002) study, for instance, highlighted the importance of implementing supply chain practices (SCPs) to meet consumer demands. Tan cited successful businesses as proof of the existence and efficacy of SCPs, such as Amazon.co Tesco, Dell Computer, and Toyota. The usage characteristics of supply chain activities may have a significant causal relationship with corporate performance. It is crucial to remember, nonetheless, that the aforementioned study did not specifically examine the inefficiencies in logistical functions or whether they impair performance, which is mainly caused by logistical problems.

Green et al. (2008) investigated the relationship between best practices in logistics and the overall performance of US-based large-scale businesses. The researchers concluded that a company's overall performance is significantly affected by the application of logistical techniques, especially in terms of timeliness, responsiveness, and delivery capabilities. The firm's marketing success, including its impact on average sales growth and trade effectiveness, is directly influenced by these factors. Regarding the improper or insufficient use of logistical functions, Kenyan agricultural enterprises have had mixed results.

1.3 Objective

To evaluate the influence of materials handling function on the supply chain management performance of agricultural firms listed at the Nairobi Securities Exchange.

1.4 Hypothesis

H₀1: There is no significant effect of materials handling function on the supply chain management performance of agricultural firms listed at the Nairobi Securities Exchange.

2.0 Literature Review

2.1 Material Handling and Its Effect on Supply Chain Management

There is a strong concern to adjust the supply system within a company (Machline, 2008) to achieve a higher service level both internally and to external customers. This elevates the operational level and may even yield a differential advantage over competitors (Milan, Paiva, & Pretto, 2006; Paiva, Carvalho Jr., & Fensterseifer, 2004). Materials handling management is among the many factors that contribute to improving a company's performance. The Materials Handling Industry of America (MHIA) defines materials handling management as "the movement, storage, control, and protection of material, goods, and products throughout the process of manufacturing, distribution, consumption, and disposal. The focus is on the methods, mechanical equipment, systems, and related controls used to achieve these functions".

The relevance of materials handling stems from its intrinsic relationship with production flow. When it presents an imbalance, there is either an excess of stock or a supply disruption. When the flow has insufficient velocity, the transit time is long, and the system is unable to serve customers when they need it. It is well understood that improvements in material handling can positively affect production. However, it is not only about production, but also about how employees perceive the new situation. When the perception is favorable, the benefits are possible; if not, behavioral issues can emerge. Evaluations are crucial when interventions are implemented in the work environment. The present work is specifically related to materials handling management. Through effective materials handling management, the company's operational performance can improve (Chopra & Meindl, 2001; Rosenbloom, 2003), thereby satisfying customers and meeting their expectations regarding their needs, desires, and demands (Oliver, 2010; Stock & Lambert, 2001).

The case study presented in this work was conducted in an automotive industry located in the northeastern part of Rio Grande do Sul State, Brazil. It was founded more than 50 years ago and is classified as a large company, with over 2,000 employees. This region contains a cluster of industries in the metal-mechanic, automotive, and metallurgical sectors, which, in the majority, belong to production chains that demand a high internal performance level from their partners. The company in question, after analyzing production flow as a whole, identified that, among other measures, it would be necessary to improve materials handling management in the manufacturing process (Rosenbloom, 2003). This was motivated by the observed delay in forklift service and its high maintenance cost. Forklifts were used for both parts handling and transportation, as well as for assisting with tooling changes, which often resulted in excessive setup time and production delays. Changes were made to the materials-handling process to address these concerns.

The primary objective of this case study was to assess the satisfaction levels of internal customers following the change. To achieve this, it was necessary to identify the factors that explain overall

satisfaction. To do this, open-ended questionnaires were used. The respondents – 26 people directly involved in the daily materials flow – were asked to identify the attributes and break them down into sub-factors, which would represent the internal process in more detail. The identified attributes were cost, service safety, service reliability, and agility. After this step, a second questionnaire with closed-ended questions was administered to the same respondents to evaluate performance satisfaction at each factor and sub-factor, as well as overall satisfaction. The questions asked the respondent for their perception of the improvement, whether or not they perceived it, after the interventions. The collected data were analyzed using multiple regression analyses. Data analysis indicated that the factors agility, service reliability, and cost can explain overall satisfaction (Stock & Lambert, 2001).

Shingo (1996) indicated that, in the West, production was treated as a sequence of operations. In the Production Function Mechanism, the concepts are directly related to a production analysis focus. A process analysis involves observing the production flows that transform raw materials into final products. From this concept, the author highlights that the primary analysis is associated with the process, as it follows the production object. The analysis of the operations comes later because it focuses on production subjects (operators and machines). When making this distinction, it becomes clear how relevant materials handling is.

According to Asef-Vaziri & Laporte (2005), a significant proportion of manufacturing expenses can be attributed to material handling, and the most critical material handling decisions in this area are the arrangement and design of material flow patterns. This idea is shared by Ioannou (2002), who argues that an important aspect of any production system is the design of a material handling system (MHS) that integrates production operations. The relevance also occurs in another context. Ballou (1993) states that storage and handling of goods are essential logistics activities, and their costs can account for 12% to 40% of total costs. Additionally, the MHIA estimates that 20% to 25% of manufacturing costs are attributed to handling (Groover, 2001). According to Sule (1994) and Apud Sujono & Lashkari (2006), material handling accounts for 30–75% of the total cost of a product along the production chain, and efficient material handling can reduce manufacturing system operational costs by 15–30%.

Bowersox and Closs (1996) state that the primary logistics responsibility in manufacturing is to formulate a master program for the timely provision of materials, components, and work-in-process. Stevenson (2001) understands that logistics (including materials and goods flowing in and out of a production facility, as well as their internal handling) has become very important to an organisation in order to acquire competitive advantages, as companies struggle to deliver the right product to the correct place and at the correct time. The main challenge is to promote, at low cost, a flow whose velocity enables the execution of the manufacturing process at the expected level of satisfaction.

According to Goldsby and Martichenko (2005), the majority of logistics systems in businesses have similar features, which explains the difficulties encountered in logistics. They continued by saying that lowering inventory levels is the only goal of logistics. There are two ways to look at inventory level problems: the company's supply chain and the global supply chain. Maintaining or reducing inventory levels at warehouses and/or retail locations is a challenge within the global supply chain. Maintaining or lowering inventory levels at storage locations or buffers is a difficulty for the company's supply chain. Inventory management systems have been promoted as a way to eliminate inventory problems and waste; nonetheless, transportation accounts for the majority of value-added operations.

Similarly, Jonsson and Mattsson (2005) proposed material handling systems (MHS) as a valuable tool to reduce non-value-adding operations in logistics. MHS strives to ensure that the appropriate material is delivered with the correct specifications to the correct location. Businesses can lower buffer levels in working areas and save operating expenses by using MHS (Jonsson and Mattsson, 2005).

According to Rumelt (2002), material handling is the manufacturing aspect that involves the initial planning, acquisition, handling, storage, and distribution of materials for manufacturing. Material utilized in production was further divided into two categories by Rumelt (2002): (a) raw materials and (b) components, parts, and assemblies. While components, pieces, and assemblies are the final results of a production process and can be used as components of a larger product, raw materials originate in primary industries. Material handling is the management of all materials. Material handling is defined by Lee and Dobler (2007) as all activities and tasks related to the transportation of materials into the business and their management up to the point of use in the production process. All actions related to the procurement, handling, management, and transportation of materials used in production fall under materials handling. To prepare their manufactured goods for client delivery, businesses typically store them in a warehouse (Hassan, 2006). Many instruments, machines, and material-handling techniques are used to manage the massive volume of raw materials and finished goods. Conveyors, manual trucks, forklifts, and other machinery are utilized to handle a variety of goods and commodities.

Material handling is one way a business can enhance its performance. Material handling is critical in manufacturing because of its inherent connection to the production flow. Excess stock builds up and disrupts the flow of materials when the relationship is out of balance. Customers eventually become unsatisfied due to the impact on production lead times. As a result, several material-handling issues have been found that may cause consumer discontent and, eventually, a loss of competitive advantage. On the one hand, Kaipia (2009) and Mulchy noted delivery accuracy, operating expenses, and information flow as the primary material handling problems. On the other

hand, inventory levels, delivery quality, and safety were identified by other authors as challenges in material handling (Hassan, 2006).

Customers are currently placing significant pressure on businesses to provide the highest-quality products, customized items, shorter lead times, and dependable delivery (Domingo et al., 2007). Therefore, adequate material flow is necessary to increase productivity and delivery performance, enabling businesses to be highly competitive (Kaipia, 2009). However, it is not easy to ensure that the material flows smoothly from production to customer delivery throughout the manufacturing process. According to Hassan (2010), firms' production sections typically include areas where material ready for use in production is stored. Because the production areas have limited space, moving such material can be challenging.

Furthermore, it becomes challenging to supply the materials required for production. Domingo (2007) highlighted the difficulties companies face in maintaining significant amounts of work-in-progress in the production area while ensuring high performance on the production floor. Hassan (2010) postulated that organizations experience lower productivity when production workstations are deprived of essential resources. Additionally, this is frequently the cause of companies' bad performance when delivering items to customers.

The case focused on the company's packaging department, in particular the Tetra pack machines and associated material flow, as the primary focus of the internal material handling system improvement; other departments, suppliers, and customers were omitted. To improve delivery performance in the packing section's shop floor, the project aimed to enhance the internal material-handling system. For the study, a tetra pack product was selected, and all its material-handling procedures were adhered to. The case company's packaging division is the only area where the recommended enhancements to the internal material handling system are applicable, and the company's policies constrain them.

Material handling is the process of moving, organizing, protecting, and storing products (Ondiek, 2009). Material handling is a crucial process since goods must be handled correctly to prevent damage and delivered to the destination in the right condition and quality. When proper material-handling procedures are followed, accidents are reduced or eliminated because the material is handled with care and accuracy. Johnson (1993) asserts that material handling increases an organization's profitability by reducing or eliminating accidents, enabling it to achieve maximum output without incurring accident-related expenses. Similarly, Okpara (2009) asserted that handling materials correctly lowers stress and effort. This suggests that when an efficient material handling system is in place, negative influences that impact material handling will be avoided. According to Lyson (2006), material management should be taken seriously. This statement is particularly relevant when transferring a large amount of material, as handling a large number of

objects can lead to accidents. As a result, organizations are forced to pay for compensation litigation.

As part of Jönköping University's master's program in production development and managerial abilities, this project was completed at a Swedish dairy production company. Early in March, the corporation was contacted, and a preliminary plan for the project's course was created. To improve delivery performance, the empirical study focused on enhancing the company's packaging section's material-handling system. The initial stage was to assess the current system and then offer improvements. However, the researcher had first to understand the guidelines and constraints for creating sections (Okpara, 2009). It was an important concern because the arrangement reflected the section's capacity constraint. Even though the researcher was already well-versed in the industry, the case study organization's employees made a significant contribution through their suggestions and ideas to improve the internal material-handling system.

The methods were chosen to correspond with the case study design. The researcher used a variety of data sources to obtain a general overview of the research area. Interviews and observation served as the study's methodological tools. This study examined the variables affecting an internal material handling system's delivery performance and the difficulties they caused. The study's first drawback was that it ignored external variables that could affect a material handling system's delivery performance, focusing solely on internal factors (Okpara, 2008). The delivery performance of a material handling system may be significantly affected by external factors, such as supplier deliveries to a business. Furthermore, a material handling system's delivery performance is directly affected by the internal factors examined. Due to the nature of the project (single case study), a second limitation was introduced. This implies that the suggested method of enhancing a material handling system's delivery performance is limited to the instance company. This is because the conditions under which the improvements are to be implemented were specified; this is one element that significantly affects how a material handling system can be improved.

Munyao et al. (2015) examined how Mombasa County's manufacturing and assembly companies performed in relation to stock management procedures. The study collected data via surveys from a sample of forty-five fabricating companies. According to the investigation, manufacturing and assembly companies use a variety of stock management techniques, such as JIT, EOQ, and periodic review methods. The analysis found that most manufacturing industry associations used activity-level strategies, even though MRP was the most effective at improving the performance of the generation division.

According to the research conducted by Opeyemi et al. (2013) on a mechanized stock control framework for grocery stores, a sizable portion of general stores use a modernized stock control

framework to learn the market's stock dimension, determine when to order additional items, maintain inventory status and updates, and support administrative decisions, advanced dimension, and stock taking. Regardless of how successful the framework may be, the analysis also showed that any product needs to be developed to be adequately flexible for future changes.

Odhiambo (2015) studied the frameworks for transporting crude materials in Kenyan agrochemical companies and how they affected the companies' operations. The investigation's goal was to determine the relationship between Kenyan agrochemical companies' operational performance and the frameworks governing the transportation of crude materials. Despite the low automation of frameworks across Kenyan agrochemical companies, the study found that crude material conveyance systems gave them a competitive edge. The study found that companies that implemented raw material transport management recognized operational viability and competence.

3.0. Methodology

A cross-sectional descriptive survey design was used in the research to target 156 workers from six listed agricultural companies. Questionnaires, interviews, and document analysis were used to gather data, which was then analyzed using descriptive statistics, Pearson's correlation and Regression model.

4.0 Findings and Discussions

4.1 Materials Handling on Supply Chain Management

The objective of the study was to evaluate the influence of materials handling function on the supply chain management of agricultural firms listed at the Nairobi Securities Exchange. The descriptive statistics is shown in Table 1

Table 1: Descriptive Statistics of Materials Handling on SCM

Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Material handling enhances continuity and consistence in the production flow	80(60.2%)	40(30.1%)	9(6.8%)	2(1.5%)	2(1.5%)
Material handling enhances positive effects over production	40(30.1%)	72(54.1%)	14(10.5%)	3(2.3%)	4(3.0%)
Material handling coordinates materials, products, equipment's, layout and human resources.	45(33.8%)	69(51.9%)	15(11.3%)	2(1.5%)	2(1.5%)
Material handling system integrates production operations	56(41.4%)	40(30.1%)	28(21.1%)	4(3.0%)	6(4.5%)
Material handling accounts for the cost of a product along the supply chain	57(42.9%)	53(39.8%)	11(8.3%)	7(5.3%)	5(3.8%)
Material handling is responsible for reducing the manufacturing system operation costs.	65(48.9%)	40(30.1%)	19(14.3%)	5(3.8%)	4(3.0%)
Material handling controls, protects and stores materials in the company.	61(45.9%)	37(27.8%)	14(10.5%)	11(8.3%)	10(7.5%)

The results on the influence of materials handling on supply chain management are presented in Table 1. The study findings indicate that materials handling is a critical function influencing the efficiency and effectiveness of supply chain operations in agricultural firms listed on the Nairobi Stock Exchange. A majority of respondents, 80 (60.2%) strongly agreed and 40 (30.1%) agreed that materials handling enhances continuity and consistency in the production flow, representing 90.3% agreement. This finding underscores the importance of effective materials handling in ensuring smooth and uninterrupted production processes. Only a small fraction of respondents were neutral or disagreed, highlighting general consensus on its positive contribution to production continuity.

The study further revealed that materials handling positively affects production outcomes, with 40 (30.1%) strongly agreeing and 72 (54.1%) agreeing, totaling 84.2% agreement. This indicates that efficient materials handling contributes significantly to improved production performance. Similarly, materials handling was perceived as a coordinating function for materials, products, equipment, layout, and human resources, with 45 (33.8%) strongly agreeing and 69 (51.9%)

agreeing (85.7% agreement). This highlights the role of materials handling in synchronizing different production components to enhance operational efficiency.

These findings aligns with Chopra and Meindl (2001) and Stock and Lambert (2001), who observed that effective material handling systems encompassing movement, storage, and control of goods are key enablers of operational efficiency and service reliability in manufacturing firms. Similarly, Asef-Vaziri and Laporte (2005) emphasized that poor material flow design increases manufacturing expenses and disrupts supply continuity, whereas efficient handling systems improve agility and responsiveness. Furthermore, Ballou (1993) and Groover (2001) asserted that material handling costs account for 12%–40% of total logistics expenses, and improvements in handling processes can reduce operational costs by up to 30%. These findings collectively support the current study's conclusion that effective material handling significantly contributes to the optimization of supply chain performance by reducing waste, enhancing productivity, and maintaining a steady flow of materials within production systems.

Correlation analysis was done to determine the nature of relationship that exists between material handling and supply chain management. The results are shown in Table 2

Table 2: Correlation Results for Materials Handling and Supply Chain Management

		Material Handling	Supply Chain Management
Material Handling	Pearson Correlation	1	.572**
	Sig. (2-tailed)		.000
	N	133	133
Supply Chain Management	Pearson Correlation	.572**	1
	Sig. (2-tailed)	.000	
	N	133	133

** . Correlation is significant at the 0.01 level (2-tailed).

The results in Table 2 indicate a moderately strong, positive, and statistically significant relationship between materials handling and supply chain management performance ($r = 0.572$, $p < 0.05$). This implies that efficient materials handling practices such as proper coordination of resources, cost reduction, storage, and integration of operations directly contribute to improved supply chain performance.

A simple linear regression was conducted to determine the level of significance between materials handling and supply chain management. The results are summarized in Tables 3

Table 3: Regression Results for Material Handling and Supply Chain Management

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
1	(Constant)	.491	.170		2.883	.005
	Material Handling	.701	.088	.572	7.981	.000

Model summary:

R=.572

R Square= .327

Adjusted R Square = .322

ANOVA:

F= 63.691

Sig. = 000

a. Dependent Variable: Material Handling

The regression analysis results indicate that material handling has a strong and significant influence on supply chain management (SCM) in agricultural firms listed at the Nairobi Securities Exchange. The model shows that material handling explains 32.7% of the variation in SCM ($R^2 = 0.327$), with the relationship being statistically significant ($F = 63.691$, $p < 0.05$). The regression coefficient ($B = 0.701$, $p < 0.05$) suggests that a unit increase in material handling practices is associated with a 0.701 unit increase in SCM. These findings highlight that effective material handling, including coordination of materials, equipment, and production resources, substantially enhances overall supply chain performance.

The correlation and regression results of the present study revealed a strong and positive relationship between material handling and supply chain management (SCM), as evidenced by a correlation coefficient (r) of 0.601 and a regression coefficient ($\beta = 0.701$, $p < 0.05$)**. This implies that improvements in material handling practices significantly enhance the efficiency and performance of SCM processes. The regression model further indicated that material handling accounted for approximately 36.1% ($R^2 = 0.361$) of the variation in SCM performance, signifying that effective handling, movement, and storage of materials contribute substantially to achieving smooth operational flow and customer satisfaction.

These empirical findings are consistent with the works of Chopra and Meindl (2001) and Stock and Lambert (2001), who established that proper material handling facilitates continuous production flow, reduces delays, and enhances customer responsiveness core outcomes of an efficient supply chain. Similarly, Asef-Vaziri and Laporte (2005) emphasized that poor design in material flow patterns increases production costs and disrupts supply chain continuity, a concern mitigated through well-structured material handling systems. The study also resonates with Ballou (1993), who noted that material handling and storage activities constitute up to 40% of logistics costs, highlighting their economic significance within SCM. Furthermore, Groover (2001) and Sule (1994) demonstrated that efficient material handling could reduce manufacturing costs by 15-30%, a finding that supports the positive influence observed in the current study.

In light of these results, the present study reinforces the argument that material handling is not a mere operational function but a strategic driver of supply chain performance. By ensuring the right materials are delivered to the right place at the right time and condition, organizations can achieve reduced production downtime, cost savings, and enhanced service delivery. This relationship underscores the importance of investing in modern material handling technologies, staff training, and process redesign to strengthen overall SCM efficiency. Thus, the study contributes empirical evidence to existing literature by demonstrating, within the Kenyan context, that optimized material handling significantly enhances supply chain management effectiveness in manufacturing and service-oriented organizations.

5.0 Summary, Conclusion and Recommendations

5.1 Summary

Materials handling was observed to significantly enhance production continuity, coordination of resources, and operational efficiency. For instance, 60.2% strongly agreed and 30.1% agreed that it ensures continuity in production flow. Regression results confirmed a strong effect with $B = 0.701$, $p < 0.05$, explaining 32.7% of the variation in SCM ($R^2 = 0.327$, $F = 63.691$). This underscores the critical role of materials handling in optimizing supply chain performance.

5.2 Conclusion

Materials handling emerged as the most influential logistical function, explaining 34.7% of SCM variation. Its contribution to cost reduction, operational continuity, and resource coordination makes it the strongest predictor of SCM performance. The conclusion is that firms prioritizing efficient handling practices achieve superior performance outcomes.

5.3 Recommendations

Since materials handling has the strongest influence on SCM, firms should prioritize mechanization and automation of handling processes to reduce costs and improve accuracy.

Training workers in modern handling equipment and safety procedures will further optimize operations. Investment in integrated layouts that streamline material flow is also recommended for improved efficiency.

5.4 Suggestions for Further Research

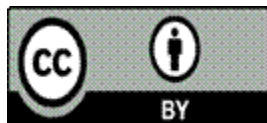
Future studies could examine the influence of logistical functions and green supply chain management in other sectors such as healthcare, retail, and construction. This would provide comparative insights and reveal whether similar patterns exist beyond production firms.

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